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ABSTRACT

This study examined the relationship between the quality of intra-group online collaboration among groups of undergraduate learners on the quality of products produced. The quality of online collaboration was assessed by the instructor and Teaching Assistant with the computer supported collaborative learning (CSCL) process assessment tool. The evolution of quality of intra-group online collaboration was examined over time, as was the quality of group products for the first and third online activity. Findings suggest that the quality of collaboration significantly impacted the quality of products produced by a group. The results of this study underline the need to provide support for the development of learners' online collaborative skills prior to the introduction of learning activities where grades are contingent upon effective collaboration. The strategy of self and peer assessment practices is introduced as a potential means of fostering the development of important collaborative skills essential to learners' successful negotiation of this novel learning arrangement. (Contains 29 references.) (Author)

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Evidence of the Need to Support the Development of On-line Collaborative Skills: An Action Research Study

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Abstract: This study examined the relationship between the quality of intra-group on-line collaboration among groups of undergraduate learners on the quality of products produced. The quality of on-line collaboration was assessed by the instructor and Teaching Assistant with the CSCL process assessment tool. The evolution of quality of intra-group on-line collaboration was examined over time, as was the quality of group products for the first and third on-line activity. Findings suggest that the quality of collaboration significantly impacted the quality of products produced by a group. The results of this study underline the need to provide support for the development of learners' on-line collaborative skills prior to the introduction of learning activities where grades are contingent upon effective collaboration. The strategy of self and peer assessment practices is introduced as a potential means of fostering the development of important collaborative skills essential to learners' successful negotiation of this novel learning arrangement.

Introduction

Educators are being encouraged to move away from directed instructional approaches and adopt a more interactive style of teaching. This fundamental shift in educator orientation involves dramatic adjustments in the flow of communication. Within such a context, learners are encouraged to interact among each other as well as with educators. One method of promoting interaction among students is to include collaborative projects in the instructional design of courses. In keeping with the current emphasis in academic institutions on social-constructivist theoretical orientations the incorporation of these learning strategies have been on the rise (Bagley & Hunter, 1992; Hansen & Perry, 1993; Morris & Hayes, 1997).

The emergence of technological tools such as computer mediated communication (CMC) software presents the potential to facilitate collaborative interaction at a distance (Keegan, 1993; Hiltz, 1994; Garrison, 1997). CMC is a specific type of human interaction that enables individuals to exchange knowledge, thoughts and feelings via technology. The culmination of this marriage of theory and technology is a powerful, dynamic learning environment unconstrained by time and space (Garrison, 1997; Hiltz, 1994; Keegan, 1993). Few would argue the compelling potential of such an active learning context, but along with this powerful pedagogical redirection come many challenges for learners.

Computer Supported Collaborative Learning

Computer supported collaborative learning (CSCL) environments are the product of constructivist approaches to learning supported by the technology of CMC software (Wenger, Holloway & Garton, 1999). CSCL can be defined as the educational use of computer technology to facilitate group learning. The CSCL process is best conceptualized as a dynamic interrelationship between several key elements which require learners to: (a) define learning goals, (b) make individual contributions to the group process, (c) negotiate roles and responsibilities, and (d) synthesize individual contribution into a cohesive group product. This interrelationship can provide learners the opportunity to build knowledge collectively (Brandon & Hollingshead, 1999; Dehler, 1998; DeSanctis & Monge, 1998; Garrison, 1997; Hiltz, 1994). However, an underlying assumption of such learning arrangements is that learners possess the skills to effectively collaborate within the on-line environment.

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Central to the concept of collective knowledge building is the ability of learners to *communicate effectively* or make the implicit, explicit. Research findings suggest that the ability to clearly, concisely, and completely represent individual understanding to others is a skill associated with high ability learners (Linn, & Burbules, 1993). Therefore, we as educators cannot assume that all learners possess this capacity.

Along with learners' individual communication competencies, the characteristics of the medium must also be considered. Perhaps the most formidable task of communicating in this setting is the mastery of the distinct form of communication that this environment demands. In effect communication in the virtual realm requires the blending of skills of reading and interpretation, writing and speech to produce a new form of human interaction.

Most educators suggest building CMC skills gradually (Berge & Collins 1995; Harasim 1996; Hiltz 1994; Misancuk 1997). In this way participants are afforded the opportunity to familiarize themselves with the technology and acquire the skill set which will enable them to communicate effectively through the medium. However, many of the strategies commonly recommended, such as dyadic partnering of learners or the placement of learners in small groups for informal electronic exchange, do not promote the development of on-line collaborative skills.

When the collaborative process is considered, aspects of group dynamics figure prominently. Unfortunately, most learners' prior educational experience has been in the objectivist tradition of instruction, where competition among learners has been strongly promoted (Shepard, 2000; Wiggins, 1993; Wilbrinks, 1997). As learners are often inexperienced with collaborative learning arrangements, generally, their knowledge about critical aspects of productive group functioning may also be lacking.

Ultimately, CSCL arrangements demand that learners synthesize individual contributions to achieve a quality group product. Yet according to Bloom's Taxonomy (1956), synthesizing at the individual level is considered a complex cognitive task. The challenge of this type of task is compounded within a CSCL learning context, as group members struggle to synthesize individual expertise in such a way that all members of the group are richer for the interaction.

Considered in unison, the challenges associated with a collaborative learning arrangement situated in an on-line learning environment are substantial. If learners' grades are contingent upon the quality of a collaboratively produced product, then methods of promoting the development of learners' on-line collaborative skills need to be considered.

The Focus of Assessment

Educators communicate to learners what content and skills are important to learn through the focus of assessment (Boud, et al., 1999). In a social-constructivist learning context effective communication is a required skill, learners' success ultimately hinges upon their ability to communicate their ideas and comprehend those of their peers. Since the purpose of assessment is to promote student learning, assessment practices need to acknowledge the importance of the communication processes and provided incentives and guidance to improve these collaborative skills (Murray, 1999).

Assessment Practices as a Means of Promoting the Development of Collaborative Skills

Proponents of constructivist pedagogy emphasize the need for assessment to become an integrated component of the learning experience (Boud, et al., 1999; Duffy & Cunningham 1996a; Shepard, 2000; Sullivan & Hall, 1997; Wiggins, 1993). Within this framework, assessment is not an end in and of itself, but instead regarded as a tool for promoting individual growth through the development of important metacognitive, critical thinking and communication skills (Frederiksen & Collins, 1998; Linn & Burbules, 1993; Stefani 1998). From a constructivist perspective, successful learners need to effectively self-monitor, evaluate and interact. By including these processes in the focus of assessment, learners are provided with feedback they can use to inform their future performance.

The Study

The current study examined the relationship between the quality of intra-group collaboration and the quality of products produced. Learners were randomly assigned to four-member collaborative group at the beginning of the semester. They worked collaboratively on three group projects over a two-month period. Group membership was stable for the entire course.

Learners' collaborative process was assessed using a tool developed within the research context. Learners received a grade for their individual contribution to the group product based on the five CSCL process assessment criteria. Group products were assessed based on predetermined assessment rubrics.

Methods

Research Context

Technology for Educational Change (EDUC 305DE) is a one-semester undergraduate course offered at a distance by the Department of Education at Concordia University through FirstClass®, a client or web-based computer conferencing system. This course is intended for pre-service teachers, and other interested students from the Faculty of Arts and Science, as an introduction to the possibilities afforded them through the integration of technology into the classroom. Forty-five percent of learners' final grades were derived from three CSCL activities. Each CSCL activity was worth fifteen percent of learners' final grades. A description of the three CSCL activities follows:

Activity 1: Structured Debate

This activity was intended to familiarize learners with the strengths and weakness of CMC. Groups of learners were paired and each group within the pair group was designated an opposing position, presenting either the strengths or weakness of CMC. A reference to an on-line journal was provided in the FirstClass® course conference. Individual learners were asked to select and read an article. Groups were then given a week to collaboratively prepare a position paper supporting their argument with the literature they had reviewed and submit the paper to their partner group for rebuttal. Only the rebuttal paper was graded.

Activity 2: Experience to Practice

This activity was designed to introduce students to the constructivist theoretical perspective by requiring them to build on individual experiential knowledge of directed instructional approaches to learning and collectively convert one of the group's individual contributions to a constructivist learning activity. Learners had two weeks to complete this assignment.

Activity 3: Design

Learners were asked to debate the pros and cons of computer use in the classroom. They were then required to design a classroom activity that incorporated the use of computers. They were asked to define the role of the teacher, indicate the educational level of the students and describe the implementation as well as how it would be assessed.

Participants

Of the 56 learners enrolled in the *Technology for Educational Change* course in the Fall 2000 semester, 52 learners completed all course requirements, 21 learners were included in this analysis. This represented a 40% participation rate. Of the 21 participants in the study, nine were education or Art Education students, 3 were from the faculty of Commerce, three were Sociology majors, 4 were Psychology majors and two were

independent students. Eleven females and ten males chose to participate in the study. According to responses to background questionnaires and information gathered over the course of the semester, participants had no prior experience in CSCL. However, students did appear to be familiar with collaborative learning in a face to face context, with 17 of the 21 participants reporting having encountered this form of instructional strategy more than three times over the course of their academic career. Half of those reported having engaged in collaborative learning activities more than ten times.

Instruments

The CSCL process assessment tool was developed in the first cycle of this action research study. It identified five assessment criteria associated with the characteristics of effective on-line collaboration and provided operational definition of each. Table 1: The CSCL Process Assessment Tool presented below was adapted from McEwen (2002). The CSCL Process Assessment criteria appear in the top row of the table. The operational definitions of each criterion are listed in the column beneath each.

Table 1: The CSCL Process Assessment Tool

Criteria	Distributed Expertise	Leadership	Provides or asks for clarification/ feedback	Clarity and Accuracy of information Provided	Quality of individual contribution
Operational definitions	shared prior knowledge or experience introduced new information, relating it to activity/discussion	initiate discussion of task/group meetings proposes deadlines defines roles posts early offers guidelines to support/ promote group interaction combines/edits group product	provides clarification on task instructions provides constructive feedback on teammate's contribution provides constructive feedback on combine group product provides information/instructions about functionality of software. requests feedback from group on combine group product asks for clarification about group member's contribution	clear concise instructions accurate information or directions	Individual component of task (article summary, personal learning experience) completeness, clarity, and utility of Introduction/ conclusion/section of assignment

Procedures

All FirstClass® messages posted by learners in their group sub-conferences, or Forums, as they became known, for each of the on-line activities were reviewed. The CSCL process assessment tool was used to evaluate the quality of intra-group collaboration. Each learner was assigned an *Instructor Assessed Individual Contribution* (IAIC) score out of five. The Instructor of the course assigned the IAIC scores for Activity 1: *Structured Debate*. The Teaching Assistant assigned the IAIC scores for Activity 2: *Experience to Practice* and Activity 3: *Design*. The instructor graded group products according to the pre-determined assessment rubrics.

Analysis

Two analyses were conducted. Given the similarity of task demand for Activity 1: *Structured Debate* and Activity 3: *Design*, a comparison of Group Product quality across these two on-line activities was made. A *t*-test was calculated on these two samples of scores. An analysis of variance was conducted to compare mean IAIC scores over time.

The Group Product scores for eleven groups for both on-line activities are presented in Table 2. The first column of the table indicates the name of the group. The second column provides the Group Product scores attained by each group for on-line Activities 1: *Structured Debate*. Group Product scores for Activity 3: *Design* appear in the third column of the table. The descriptives of Group Product scores are presented in the final rows of the table.

IAIC scores for Activity 1: *Structured Debate*, Activity 2: *Experience to Practice*, and Activity 3: *Design* are presented in Table 3. Learners are identified in the first column of the table. IAIC scores appear in the following three columns respectively. The final rows of the table indicate the means and standard deviations for each sample of scores.

Table 2: Group Product Scores for Activity 1: *Structured Debate* and Activity 3: *Design*

Group	Group Product Scores Activity 1: <i>Structured Debate</i>	Group Product Score Activity 3: <i>Design</i>
1	75	93
2	92	77
3	58	93
4	92	100
5	58	87
6	63	87
8	75	87
9	67	93
10	54	77
11	38	97
12	58	93
Mean	66.36	89.45
SD	16.26	7.39

Results

The quality of Group Products improved significantly from Activity 1: *Structured Debate* to Activity 3: *Design* ($M = 66.36$, $SD = 16.36$) to Activity 3: *Design* ($M = 89.45$, $SD = 7.39$). All but one group scored remarkably higher in the final group product. A *t*-test revealed that Group Products scores were statistically significantly higher for Activity 3: *Design*, $t(13) = 4.03$, $p < .01$. A possible explanation is the improved collaboration within groups as represented in improvement in IAIC scores across tasks.

According to mean IAIC scores learners' collaborative performance improved significantly over time. There was a steady rise of the means of the IAIC scores over time, $M = 2.81$, $SD = .98$; $M = 3.64$, $SD = .59$ and $M = 4.75$, $SD = .48$, respectively. The CSCL process assessment tool does appear to have captured improvements in learners' collaborative performance across tasks. An analysis of variance revealed statistically significant

differences among the three means of the IAIC scores, $F(2,60) = 31.62, p < .01$. This finding suggests a degree of stability both in the improvement in learners' collaborative skills and in the CSCL process assessment tool.

Table 3: IAIC Scores for On-line Activities

Learner	IAIC Scores for Activity 1: <i>Structured Debate</i>	IAIC Scores for Activity 2: <i>Experience to Practice</i>	IAIC Scores for Activity 3: <i>Design</i>
1	3.5	4.0	5.0
2	3.5	3.5	4.0
3	3.5	3.5	5.0
4	3.0	4.5	5.0
5	4.0	3.5	5.0
6	3.0	3.5	4.5
7	5.0	4.0	5.0
8	2.0	3.5	5.0
9	3.0	4.0	5.0
10	2.5	3.5	4.5
11	2.0	4.5	5.0
12	2.0	3.5	4.0
13	4.0	4.0	4.5
14	3.0	4.5	4.0
15	3.0	4.0	5.0
16	3.5	3.0	4.5
17	1.0	3.0	4.0
18	1.5	2.0	4.0
19	2.5	3.5	4.5
20	2.0	4.0	5.0
21	1.5	3.0	3.5
Means	2.81	3.64	4.57
SD	.98	.59	.48

Discussion

The Inter-relatedness of the Quality of Process and Product

There appears to be a definite positive relationship between the quality of process engaged in by groups and the quality of products produced. The stunning improvement in the quality of Group Products from Activity 1: *Structured Debate* to Activity 3: *Design*, as shown by the increased grades on the final group products, coupled with the tremendous improvement in collaborative performance as represented in the rise of IAIC scores between activities supports this hypothesis.

This finding raises the important issue of the need to support the development of learners' collaborative skills early on. Apparently, a learning context characterized by a collaborative learning orientation within an on-line environment posed unfair challenges for learners. Upon reflection, we feel strongly that self and peer assessment practices offer educators a means of providing the support learners may require. We suggest that if these practices are appropriately orchestrated within a learner-centered context, learners can be successfully supported through this adaptation phase. These practices can draw learners' attention to the types of activities

that promote effective collaboration. Furthermore, as the assessment process unfolds learners stand to further benefit through the development of evaluative and self-monitoring skills.

Conclusion

The findings of this study suggest it is unrealistic to expect learners to suddenly adopt a collaborative learning orientation without supporting the development of social skills necessary for their success. Learners need to understand what constitutes effective collaborative interaction within an unfamiliar learning environment. Self and peer assessment practices offer educators a means of supporting learners' emergent understanding of this learning orientation and the manner in which it is expressed on-line.

A central tenant of the self and peer assessment literature is learners' ownership of the assessment process. According to researchers exploring self and peer assessment practices in on-site learning contexts, feeling of ownership grow out of the act of learners having a hand in either the creation or definition of assessment criteria (Dochy et al. 1999; Topping, 1998). Activities such as these are also believed to foster deeper understanding for learners (Falchikov, 1993; Stefani, 1998). Therefore, truly supporting the development of collaborative skills would require that learners be included in the negotiation of the meaning of the characteristics of effective collaborative interaction. The impact of which could very well be the expression of this knowledge in learners' on-line practice. Consequently, the strength of the CSCL process assessment tool lies in the directing of learners' attention to important characteristics of effective collaborative interaction.

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